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ARMAMENT

STUDENTS' NOTES

PART I.

MACHINE-GUN PRINCIPLES

OBJECT OF COURSE: To learn the working of a machine gun and the care necessary in its handling and maintenance.

All must be prepared in an emergency to handle it in defence against enemy ground or air attack.

Instructions divided into nine parts. I: machine gun principles. II: mechanism. III: mechanism (continued). IV: stripping and reassembling. V: gun action. VI: magazines. VII: loading and unloading. VIII: stoppages and tools. IX: care and maintenance of gun and magazines.

THE MACHINE GUN

1. The name 'machine gun' normally means a gun which will continue to fire without attention while the trigger is pressed and while the ammunition in the feeding device lasts.

2. Ammunition

The ammunition is counted in ROUNDS.

Each round consists of the BULLET or projectile, and the CARTRIDGE CASE.

The case for the British rifle, Lewis, Vickers and Browning guns is rimmed.

At the base of the cartridge is a CAP, which—when struck—causes the charge of explosive inside the brass cartridge case to ignite and create gases which expand rapidly and cause pressure.

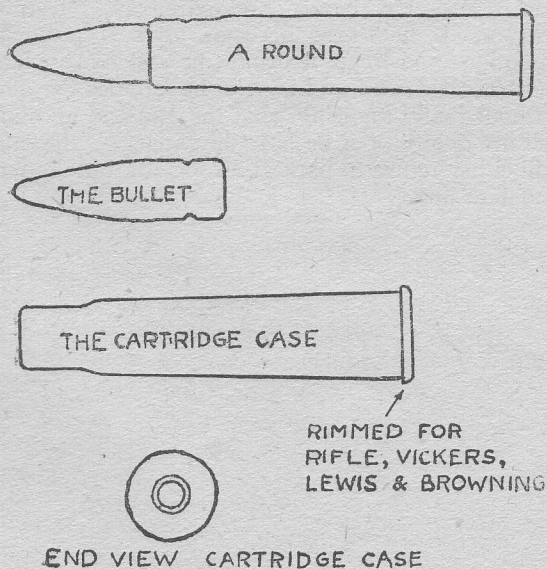


FIG. 1.

The extremely high pressure of gas expansion forces the bullet from the case, and through the gun barrel towards the target.

After a bullet has been fired, the brass cartridge case left is known as THE EMPTY CASE.

3. **Feed.** Ammunition is said to be 'fed' to a gun; and may be effected by a belt feed, a magazine feed (the magazine driven by the gun's movement) or a spring magazine feed.

4. **The Breech.** Here rounds are fed in one after the other for firing, and the barrel breech end is especially shaped to take the complete round, bullet and cartridge case.

5. **The Barrel.** Receives the round at the breech-end. The gas from the propellant charge in the cartridge drives the bullet along the barrel and out at the muzzle end. Just as a gyroscope keeps straight and true when it is spinning, a bullet follows a straighter flight path when it also is spinning. Therefore, we 'rifle' or cut twisting grooves inside the barrel. When the bullet is forced along the barrel, this rifling sets it spinning on its forward flight.

6. **Locking the Breech.** It is obvious that the breech end of the barrel must be open when the round is introduced, and that it must be tightly shut before the round is fired. The slightest opening at the breech end would allow the violent escape of gases into the face of the gunner. Such a gas escape is known as 'blow back'. The sealing of the breech is effected by a block of metal known as the 'breech block' or the 'bolt'.

7. **The Striker.** After the breech block is closed, a small 'safe period' of time is allowed. Then a tapered pin, called 'the striker', darts forward, hits the cartridge cap, and causes the chemicals inside the cartridge case to ignite and generate expanding gases which drive the bullet forward. A great deal of heat is generated in this process; hence the saying 'the bullet nips smartly down the barrel, hotly pursued by the gases'.

8. **Unlocking the Breech.** When the bullet has left the barrel and the pressure of the gases had died down, the bolt, or breech block, unlocks to allow the introduction of the next round. Before this can be done, however, we must get rid of the empty case which lies in the breech.

9. **Extraction.** The empty case is neatly extracted by fitting on to the face of the bolt, or breech block, little steel jaws. The jaws grip the cartridge case at the rim, and when the breech is

unlocked the cartridge case is pulled backwards out of the end of the barrel. A good simile is that of a decayed tooth being extracted.

10. **Ejection.** The empty case, held between the small steel jaws, is now moving back inside the body of the gun. It must be got rid of, so it is given a smart tap which knocks it through an opening in the side of the gun on to a metal plate, which is usually set at 45° , to the ejection opening. The tooth has now been thrown into the pail.

11. **Deflection.** On striking the metal face the empty case is deflected at an angle to prevent it returning to the gun, and it falls into a canvas receptacle called the 'deflector bag'. The tooth has hit the side of the pail and fallen to the bottom.

12. **The Trigger.** This gives the gunner mastery of the gun and allows him to decide when the striker pin shall be put into operation.

13. **Cycle of operations.** We thus see that the complete cycle consists of Feeding, Locking, Striking, Unlocking, Extracting, Ejecting, and Deflecting.

14. **More About the Gases.** An old law says that every action has an equal and opposite reaction: this holds true for the expanding gases inside the gun. Besides giving the bullet a powerful push forward, they exert a powerful push backwards as well. This backward force is used to turn the gun into a machine or automatic gun in the following way.

15. **The Recoiling Portions.** These form a piece of mechanism which travels backwards under the force of the expanding gases, and comes up against buffers at the rear end of the gun. When the shock of recoiling has been dissipated by the buffers, the recoiling portions are driven forward again by springs. They take with them another round and feed it into the breech. The bolt, or breech block, then closes on the round and we are ready to fire again.

16. **More About the Trigger.** It will be seen from the above that once we have set the gun going it will continue to fire automatically until

all the rounds are exhausted, unless we can control it. This is where the trigger comes in. When the trigger is pressed, it is clear of the recoiling portions, and allows them to go to and fro unhindered. When the trigger is not pressed, it stands in the way and stops the movement of the recoiling portions. Thus if we get a defective trigger which fails to stop the recoiling portions from working, the result is a 'runaway' gun.

17. **The Bent and the Sear.** The trigger does its particular work by being fitted to a sear which can be engaged with a bent on the recoiling portions.

BENT & SEAR PRINCIPLE

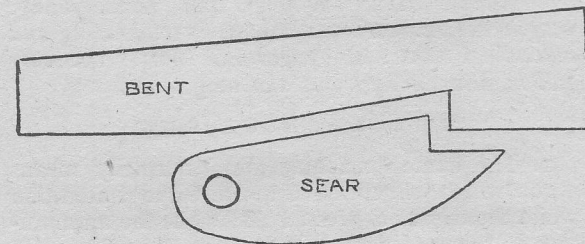


FIG. 2.

18. **Safety Devices.** As machine guns fire anything up to 1,500 rounds per minute, a slight error in mechanism timing could have serious results. Charges exploding before the breech is properly locked, and a fresh round being fed in before the empty case of the previous charge has been extracted from the breech, are two examples of things which might go wrong. Such undesirable events are prevented by fitting 'safety devices'. A gun may have three to six such devices.

19. **The Machine Gunner.** The machine gunner has under his hands an extremely powerful weapon. If he learns his gun, gives it personal attention, and treats it firmly, he will find in it a most useful friend and ally. If he handles the gun without really knowing what the gun and he himself are doing, or if he has 'lily fingers', the gun will either refuse to bark at all, or else turn round and bite him.

PART II

VICKERS GAS-OPERATED GUN: MECHANISM

Gas Operation

1. The Vickers gas operated gun has two salient points which stand out immediately:—

- (i) It is gas operated;
- (ii) it is magazine fed.

A gas operated gun is one that uses part of the gases to drive the bullet down the barrel and part to reload and recock the gun.

The heavy portion on the barrel is called the gas block; it has in it an outlet or a port from the barrel. When a bullet passes the gas block it leaves behind it gases still under high pressure, and having done their work on the bullet a good deal of them escape through the gas block port to the gas cylinder.

2. All the recoiling portions are mounted on a rod with a piston head which runs inside the gas cylinder. This piston rod is hollowed out at the rear end and contains two springs, one inside the other. These are called the inner and outer return springs, and are wound right and left handed respectively to prevent a lop-sided thrust. These springs come into action once we have pulled the recoiling portions to the rear by hand to get the gun going. If the trigger is then pressed and kept pressed the gun becomes fully automatic.

Magazine Feed

3. Rounds of ammunition are fed into the gun from a magazine of this type, which is clipped on to the gun and operated by mechanism with which it is then automatically connected. A magazine feed has disadvantages and advantages. On the debit side the largest magazine manufactured for the hand-held gun holds only 100 rounds. Firing 950 rounds per minute, or 16 rounds per second, the magazine could only give a burst of continuous fire for $6\frac{1}{2}$ seconds. On the credit side the gun complete with magazine is compact and when reasonably mounted has a good field of fire through which it can be swung to bear at any angle without the feed being affected.

Other Main Points About Gun

4. When in action the gun has no external moving parts.

The recoiling portions can be removed from and returned to the gun in five seconds.

The whole gun can be stripped in one minute.

The barrel can be removed separately without disturbing recoiling portions.

There are eight split pins that the gunner has to think about:—

- (i) Flash eliminator,
- (ii) Gas block,
- (iii) Gun yoke,
- (iv) Sights,
- (v) and (vi) Cocking handle,
- (vii) and (viii) Body extension cover.

All are easily visible for checking.

The better a gun is looked after the more reliable it becomes. Well-cared for guns have been used at high pressure and for long periods on ground practice ranges without air pressure slip-streams to cool them and have stood up to the work extremely well. They are tough and reliable guns.

The magazines must be looked after carefully. The best gun in the world will cease firing or jam if it is fed by a magazine which has been dented, distorted, clogged with grit, mud, or grass through careless handling or dropping. *This always should be remembered. Too much importance cannot be attached to it.*

The Recoiling Portions

5. All these portions have a polished finish. Let this be a constant reminder that they must never be allowed to rust or burr up.

Consider the recoiling portion in two parts, the piston rod and the breech block.

The piston head receives the force of the gases. The collars half way down the piston rod are steadies which have flats on the left hand side to avoid fouling the cocking piece. Next come the shoulders which take the shock on the piston stops in the body when the piston is arrested in its forward motion. The groove in the left hand side of the squared portion at the rear is called the cocking slide.

The hole drilled centrally from the rear end houses the return springs.

Remembering the method of stopping a machine-gun, look on the underside of the rear end of the piston. The wedge shaped groove is obviously the bent into which the sear engages. The sear rotates below on a non-recoiling portion of the gun.

Above the rear end are locking and unlocking cams which are called the front and rear projections.

6. The breech block is made as light as possible by drilling away unwanted material because it has a multitude of tasks to perform.

(i) The inclined lower rear face has a locking action. The raised portion on the top of the rear end is called the locking land.

(ii) The internal upper inclined surface has an unlocking action.

(iii) The firing pin is held inside the breech block by a lateral retaining pin and at appropriate moments is driven through the firing pin hole compressing the spring.

(iv) On the right hand side of the breech block is a housing for the cartridge case extractor and extractor spring.

(v) The lever on the top forward edge is the feed piece. It is pivoted on an axis pin and when free a plunger and spring force the front end upwards.

(vi) The slot in the leading edge of the left hand side is known as the ejector clearance slot.

(vii) The smooth cut away portion, which covers two thirds of the length from rear to front on the upper left hand edge, is the cam for the ejector.

Those with a retentive mind for mechanical detail will have a shrewd idea by now of how the gun works. However, for the present just remember that the breech block houses (i) the feed piece, (ii) firing pin, (iii) extractor, (iv) ejector.

The Non-Recoiling Portions

7. All the outside surfaces are blued to protect them against rust.

A notable feature of the gun is the short external length of barrel. It is tapered towards the muzzle end on which is screwed the flash eliminator and front sight bracket. *Never hold the gun by the end of the barrel and then take its weight.*

Lower down is the gas block, covering the gas port through which gases flow to the gas cylinder.

The two machined collars on the upper surface of the barrel are called locking grooves. They take the barrel strap which secures the barrel to the body of the gun. The grooves are of unequal width to prevent wrong assembly.

Also attached to the barrel are the rear sight bracket and the front magazine catch.

Notice that the end of the barrel does not resemble a squarely sawn off metal tube, but has two projections called the cartridge rim stop.

To summarize, the barrel group consists of (i) flash eliminator, (ii) front sight bracket, (iii) rear sight bracket, (iv) locking grooves, (v) front magazine catch, (vi) gas block and port, (vii) cartridge rim stop.

8. The body of the gun is called the breech casing. The cocking piece, slide, and handle move in and about the slot on the left hand side. On the top is the feed opening and the rear magazine catch. Immediately below this is the cut away portion into which the breech block is locked.

On the right hand side are the ejection slot and the deflector catches. Below are the deflector lugs to locate the deflector hinge pin. The spring magazine catches and the deflector hinge pin are both split pinned.

The barrel group slides into the forward upper housing; but it is obvious that the gas cylinder must first be entered into the lower aperture. Notice what a beautiful internal finish the gas cylinder has.

The barrel strap secures the barrel to the body of the gun, and lines up holes with those in the body to attach to a yoke for mounting the gun.

At the rear end of the body are two smooth grooved pins which are retained by springs. These attach the body extension and will be described in detail later on.

Apart from the body extension there only remains now the opposite wound, concentric return springs, return-spring guide, and the gas block. The gas block screws into the gas cylinder and is fixed by a split pin in an offset drilled hole.

PART III

VICKERS GAS-OPERED GUN: MECHANISM (continued)

The Body Extension, or Back Block

1. The stout L-shaped back block, drilled longitudinally for its two buffers and laterally for its securing pins and many axis pins, is surprisingly compact for the number of tasks it performs.

The BACK BLOCK is surrounded by the HAND GRIP frame of pressed steel and secured to it by two bolts with heads slotted for a screw-driver. The BODY EXTENSION includes:—

- (i) The main buffer,
- (ii) The trigger and mechanism,
- (iii) The sear and buffer,
- (iv) The sear catch,
- (v) The safety catch.

Each part will be considered separately below.

The Main Buffer

2. A hole is drilled in the back block, in line with the piston, to accommodate the cylindrical buffer against which the piston rebounds.

The buffer is drilled to form a bearing and housing for the return-spring guide. The rear end of the buffer is enlarged in diameter to prevent it being pressed forward and out of the back block by the buffer spring which bears against it.

The rear end of the buffer housing in the back block is internally threaded so that the BUFFER-SPRING RETAINING CAP can be screwed into it; the retaining cap is locked in position by a transverse pin.

A steel BUFFER DISC, of tough steel similar to that used in the buffer itself, is placed between the retaining cap and the buffer spring.

The buffer withstands considerable shocks successfully some 950 times per minute when the gun is firing.

The Trigger and its Mechanism

3. The trigger resembles a butcher's cleaver; the rounded top edge is designed to engage the safety catch.

A hole at the base is drilled so that the longitudinal trigger rod can be connected by a pin.

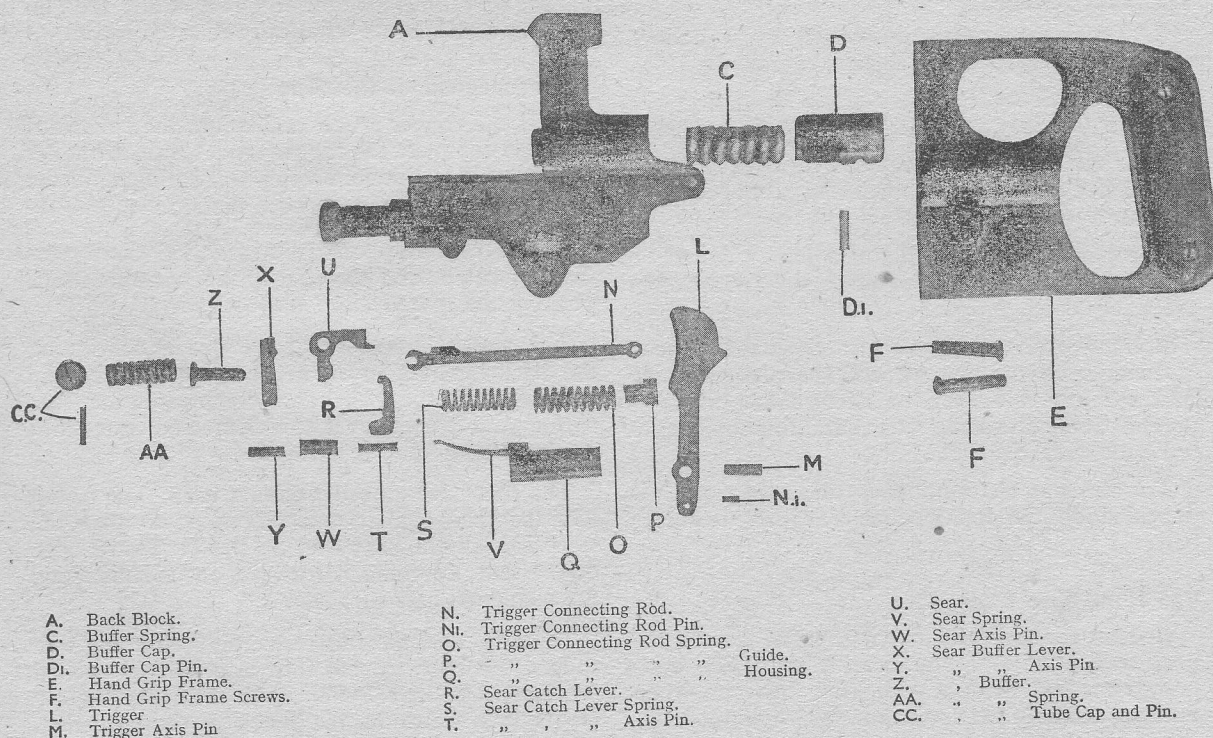
The larger hole drilled slightly higher in the trigger is employed as a connection to and pivot for the rear of the back block.

A longitudinal rod transmits the trigger motion about its axis to the sear. The front end of this rectangular rod is forked to engage the sear; immediately behind the fork a stop is riveted.

About the rod is assembled a trigger-spring sleeve, trigger springs, and trigger-spring cap. A lug prevents the sleeve from turning when assembled in the back block; there it bears against a shoulder in the housing.

The light sear-catch spring is carried on the rod in front of the sleeve, the slightly heavier trigger connecting rod spring on the lug on the sleeve.

To learn the part names refer constantly to the photograph given below.



The Sear and Sear Buffer

4. The roughly L-shaped sear is pivoted on an axis pin seated in a slightly elongated hole forward in the back block. This permits a slight movement forward against the sear buffer.

During this movement forward the curved under-portion of the sear engages a transverse pin. This causes the sear to rise to its fullest extent, and a lug at the rear limits the upward movement.

The sear is cut away on its forward face so that a sear lever pivoted in the back block may bear on it. The sear lever bears against a longitudinal buffer plunger, which in turn compresses a buffer spring housed in the elongated tubular extension. It resembles a water pistol, and is secured by a screwed plug and pin.

The Sear Catch

5. This resembles two bent fingers pivoted on an axis pin at the knuckles; the parallel arms pass one each side of the trigger rod previously mentioned. The tops of the fingers hold the lug on the sear after full trigger pressure has been applied and until it is *fully* released.

Compression of the light spring on the trigger rod, forward of the spring sleeve in the forward movement of the rod, applies the catch.

The riveted stop on the trigger rod releases it at the end of the backward travel of the trigger rod when the trigger is fully released.

The Safety Catch

6. The safety catch is worked by a hollow, semicircular thumbpiece clearly engraved:

F for FIRE;
S for SAFE.

Near the axis of the thumbpiece is a projection to which a plunger is pinned. This connects it to the safety catch.

The plunger passes a plunger guide pivoted on trunnions (a projecting pin either side) in a slot in the safety catch proper.

Pressure of the small safety catch spring between a shoulder on the plunger and the plunger guide makes it impossible for the safety catch (which is pivoted about the same axis as the thumbpiece) to hover between FIRE and SAFE.

The axis pin for thumbpiece and safety catch is provided by the top wooden side piece securing bolt.

The Hand Grip Frame

7. This conceals the moving parts, houses the FIRE and SAFE, and provides the grip. The best-known method to date of holding this gun when used as a hand-held single gun is as follows.

Form the thumb and adjoining finger of the right hand into a small cup as though holding a slender billiard cue. Using the middle finger as a trigger-finger, place the chin in the cup formed by finger and thumb and splay the remaining two fingers round the wooden hand grips. Check lateral movement of the gun with this arm by hugging the right elbow close to the waist. Place the four fingers of the left hand over the top of the front end of the body extension to check vertical kick of the gun in a tight grip.

Only concentrate rigidly when firing. If the gun jumps the head should move too, and should you lose the target in your sight release trigger, resight, press trigger. The left hand is free for rapid automatic immediate action.

Trigger and Sear Action: Depression

8. The safety catch is placed to FIRE, and the trigger is pulled right back. The trigger pivots about its axis pin and causes the trigger connecting rod to move forward, compressing the trigger connecting rod spring.

The forked end of the connecting rod engages on the lower leg of the sear, causing it to rotate about its axis. This depresses the leaf sear spring which projects from the connecting rod spring housing.

When the sear is down to its fullest extent the light sear catch spring (now under compression) causes the sear catch to rotate and catch the lug on the sear, thus holding it down whilst the gun is firing until the trigger is *fully* released again.

Re-engagement of the Sear

9. If the trigger is released before the backward action is complete the trigger moves forward under the impetus of the connecting rod spring until the main buffer checks its forward motion.

The riveted stop on the trigger rod disengages the sear catch, and the sear spring reasserts itself, pushing the sear up into the bodyway.

The rear of the base of the piston continuing the backward action of the gun, impinges on the gentle gradient of the sear, compresses the sear spring and passes over the depressed sear until the bent in the piston is reached.

The sear once moved reasserts itself. The piston hits the main buffer and rebounds; so that the steep side of the bent engages the backward edge of the sear, carrying it forward on its axis along the elongated axis pin hole.

In doing this, the transverse pin below the sear causes the sear to rise into a positively locked position. The sear buffer lever, rotating slightly on its axis, transmits the shock to the hardened,

tough steel sear buffer and springs; the recoiling portions are brought to rest gently but firmly and the gun is cocked.

General Hints

10. Do not strip the Body Extension without permission of the Senior Gunnery Officer or N.C.O.

Watch the sear for cracks; the sear buffer cap locking pin for looseness; and the hand grip frame for cracks.

At first do not worry unduly about learning the body extension mechanism in detail. Remember (a) that the sear can be depressed without pressing the trigger. (b) the sear axis pin hole is elongated and a buffer is provided. Then settle down to learning the general gun mechanism first.

Learn the grip and immediate action without having to move the head from the sighting position.

PART IV

VICKERS G.O. GUN: STRIPPING AND REASSEMBLING

I: Note

1. Part III only served as an introduction to the real business of learning the gun—handling it; first with supervision, then unaided.

Select a bench with a vice, and clear it of all other material, particularly parts of other guns.

Strip the gun methodically, and lay out parts one by one in an orderly way.

Memorise names of parts; without this, future discussions will be difficult. Mannock, Ball and McCudden knew their guns backwards, and this gun is far easier to learn, more robust to handle, and easier to strip than were theirs.

II: Stripping

2. (i) See that gun is unloaded (i.e., remove magazine).

(ii) Remove sights and stow carefully.

(iii) Place gun in cleaning jig provided.

(iv) Cock the gun by pulling back the cocking handle.

(v) Lean against the back block and strike out the body extension securing pin by tapping the ends opposite the heads with the heels of the hand, then pulling on the heads simultaneously to their full extent.

(vi) Cup the body extension (back block) in the right hand, and withdraw it from the body complete with recoiling portion.

(vii) Remove breech block from top of locking cams on piston rod.

(viii) Hold piston head against bench and secure piston with left hand. Press trigger with right hand; this disengages the sear from the bent in the piston. The return springs exert themselves and the right hand is eased back until the springs are out of compression.

(ix) Place piston rod, return springs and return spring guide on bench. Always keep back block separate in a clean place.

(x) Remove the deflector casing.

(xi) Up-end the gun and stand it on the plain face at the rear end; remove the bolt securing the yoke and barrel strap.

(xii) Remove barrel strap.

(xiii) Lift out the barrel group.

(xiv) Lift off the gas cylinder.

The gun is now stripped down to its major component parts:—

(a) Barrel group.

(b) Breech casing.

(c) Breech block.

(d) Gas cylinder—Cannot be stripped any further.

(e) Piston rod—Cannot be stripped any further.

(f) Back block—Should not be stripped any further.

Barrel Group

3. (i) Secure Barrel Group in a vice with special clamps.

(ii) Remove split pins from flash eliminator and gas plug.

(iii) Remove gas plug and flash eliminator with special spanners; both threads are right-handed.

(iv) Remove front sight bracket, pointing out that it was keyed on.

(v) Remove gas block.

Do *not* remove front magazine catch.

Breech Casing

4. (i) Pull out casing slightly, and pull back the spring cover of the ejector.

(ii) Using extractor spring cover, tap in the rear end or heel of ejector until toe sticks out at 90° to the casing.

(iii) Remove ejector.

Do *not* dismantle rear magazine catch.

Breech Block

5. Learn to strip this with speed. Here lie most of the stoppages.

(i) Force out extractor spring by pressing rear end forward with soft drift. Remove extractor.

(ii) Keep thumb pressed on feed piece. (If you don't you will be grovelling round for a fortnight afterwards on your hands and knees looking for the feed piece plunger and spring.)

(iii) With fine punch press out transverse axis pin.

(iv) Place feed piece, feed piece axis pin, feed piece plunger, and spring in a piece of clean rag.

(v) Place thumb over firing pin inside hollow of breech block with small screw driver. Screw out firing pin retaining pin.

(vi) Place firing pin, firing pin spring, and firing pin retaining pin in the rag with other parts of the breech block.

The gun is now stripped as far as regulations permit it to be other than by fitters/armourer.

III: Reassembling

6. Reassembling usually follows cleaning and inspection. It is usual to commence cleaning the barrel group first and the recoiling portions last. The barrel treatment often means a 20-minute wait; so recoiling portions are cleaned and reassembled during this waiting period.

Breech Block

7. (i) Fit feed piece plunger and spring.
- (ii) Line up feed piece and push axis pin flush in.
- (iii) Fit firing pin and spring. Hold in position, screw in firing pin retaining pin.
- (iv) Fit extractor.
- (v) Push extractor spring into rear extremity.

Breech Casing

8. (i) Introduce toe of ejector at 90° to slot pivot flush on its axis.
- (ii) Slide home the spring cover.

Recoiling Portions to Breech Casing

9. (i) Place fully assembled breech block on piston in FORWARD OR UNLOCKED position.
- (ii) Introduce piston head into lower guide-way of breech casing, depress feed piece and slide piston and breech block to forward position.
- (iii) Place return springs on return spring guide; insert in housing in piston.
- (iv) Place rear end of return-spring guide into body extension (in housing of main buffer), AND BE SURE IT IS ENTERED SECURELY IN THE COLLAR.

(v) Compress spring by forcing back block up to rear jaw of breech casing; press home the body extension securing pins with the palms of the hands.

Barrel Group

10. (i) Fit gas block.
- (ii) Fit front sight bracket. SEE KEYWAY LINES UP WITH KEY—Don't force it.
- (iii) Screw on flash eliminator.
- (iv) Split-pin flash eliminator.
- (v) Screw in gas plug. ENSURE THE GAS VENT POINTS FORWARD.
- (vi) Split-pin gas plug.

Barrel Group to Breech Casing

11. Prepare gas cylinder and barrel strap beforehand.

- (i) Slide gas cylinder over piston head REDUCED PORTION FIRST; slide into breech casing.
- (ii) Slide barrel group into breech casing. Ensure gas block collar enters gas cylinder.
- (iii) Fit barrel strap.
- (iv) Fit yoke and bolt securing yoke and barrel strap to breech casing.
- (v) Split-pin nut.

Deflector Casing

12. Fit on to gun.

THE VICKERS G.O. GUN: ACTION

*I: Backward Action***Propelling the Bullet**

1. Assume that the cap in the base of a cartridge has been struck whilst the round is locked in the breech of the gun.

This cap ignites the sticks of cordite in the cartridge and generates heat and gases. The rapid gas expansion which takes place forces the bullet down the barrel grooves. It leaves the muzzle end at 2,440 feet per second, or roughly 1,600 m.p.h.

Escape of the Gases

2. When the bullet passes the gas block, it uncovers the port to the gas plug, and some of the gases under pressure seek this means of outlet in an attempt to return to normal atmospheric pressure.

A proportion of these gases are led by the curved passage in the gas plug into the gas cylinder; other gas escapes by the outlet port in the front of the plug.

Gas escape Hole

3. As in most weapons, there is a gas-escape hole in the breech block. Gas still under pressure passes through the hole, to the forward interior inclined surface, and then quietly dissipates.

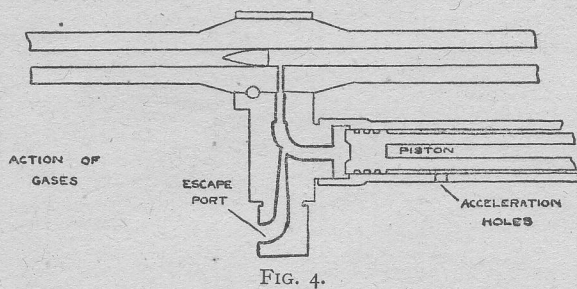


FIG. 4.

Action of Gases on the Piston

4. The gases that enter the gas cylinder impinge on the concave head of the piston, driving it backwards and compressing the return springs.

The piston accelerates during this process, from zero to 40 m.p.h. in less than $\frac{1}{30}$ th of a second. So that when the piston head uncovers the holes in the gas cylinder, the gases still under pressure are able to dissipate quickly before the next cycle of operations begins $\frac{1}{15}$ th of a second later.

Breech Block: Safety Device

5. It will be recalled that before the piston rod started its backward movement the breech block was sealing the breech. That is, the locking land on top of the breech block was in the recess in the breech casing, and the straight part of the rear

projection of the piston rod was below the breech block.

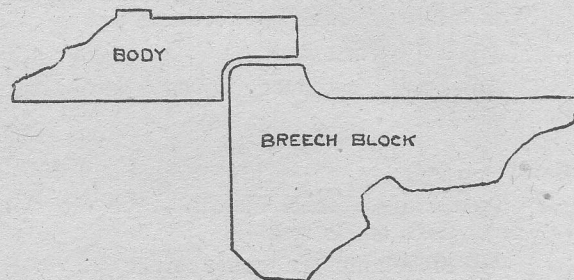
BREECH LOCKING

FIG. 5.

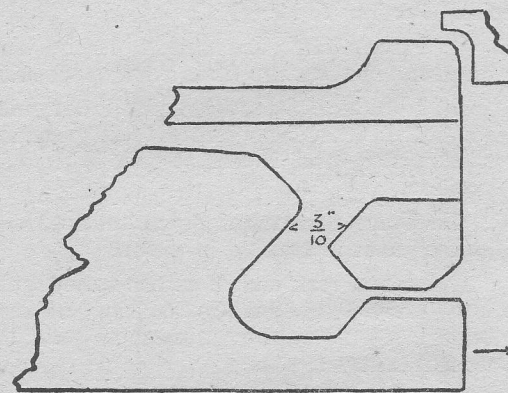
**SAFETY SPACE**

FIG. 6.

Therefore, the piston rod can move back $\frac{3}{10}$ th of an inch without the locking of breech being disturbed. While the piston rod moves this distance, the bullet leaves the barrel, and most of the pressure behind it is dispersed before the breech is unlocked.

Unlocking the Breech Block

6. The piston continues its backward travel, and the lower rear inclined face of the rear projection of the piston comes into contact with the upper inclined face on the inside of the breech block.

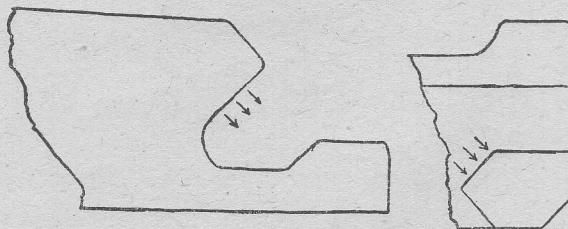


FIG. 7.

This forces the breech block down, out of the locking recess in the breech casing. The breech block and piston rod now move backwards together.

Empty Case: extraction

7. An empty cartridge case is gripped by its rim and held on the face of the breech block by the extractor claw. The empty case is thus automatically extracted from the breech with the backward action of the recoiling portions.

Empty Case: ejection

8. Imagine the breech block fully forward. The ejector, which can rotate on its own axis, is then lying so that the 'heel' or 'tail' projects into the breech casing, accommodated in a cut-away part of the breech block.

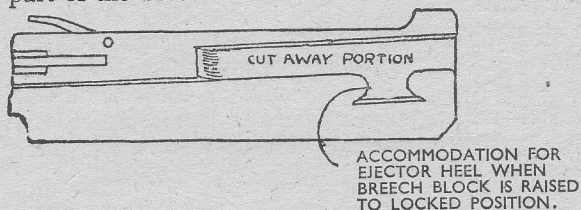


FIG. 8.

Now when the breech block brings back the empty case, the case comes opposite to the ejection opening on the right-hand side of the breech casing. At the same time the part of the breech block which is *not* cut away has slid back and pushed the tail of the ejector out. The ejector rotates on its pivot; in comes the nose through a slot in the breech block. The base of the empty case thus receives a smart tap. This twists the case rim from the extractor claw, and the case flies out through the ejection opening.

Empty case: deflection

9. To prevent extremely hot empty cartridge cases shooting all over the place as the gun fires, the cases are deflected into a container, usually a canvas bag made on a wire framework and secured over the ejection opening on the gun.

The ejected case hits a 45° metal face on the gun, changing its direction of travel from horizontal to downwards, and thus into the bag.

Bent and Sear Action

10. Despite the force needed to (i) move the piston (ii) unlock the breech (iii) pull out the empty case (iv) work the ejector, and (v) compress the return springs, the pressure of gases is still sufficient to keep the recoiling portions moving rapidly.

Imagine that the trigger is not pressed. Then the sear will stand 'proud' of the back block—the inner surface of the bottom rear breech casing.

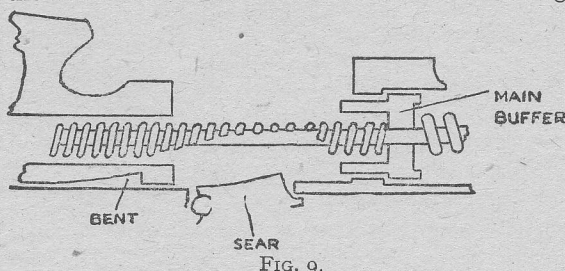


FIG. 9.

Back comes the piston, sliding over the sear (by reason of its gentle gradient) and forcing it down. The piston continues back, compressing the return springs to their full extent. The last of the recoil shock is absorbed between return-spring guides and main buffers.

The compressed return springs try to force the piston forward again, but meanwhile the sear has come directly underneath and popped up by spring action into the bent. So that the steep sides of the bent and sear now butt against each other and prevent return of the piston.

If the sear were not 'cushioned', it would undoubtedly fracture under the shock of the sudden thrust by buffer and return springs. Cushioning is provided by elongating the sear axis pin slot hole, and giving the pin a spring buffer to further absorb shock.

The gun is now cocked.

Feed Piece: backward action

11. First a round is fed and fired; then full recoil takes place before the next round has time to move into the magazine 'cartridge guide lips'.

The feed piece is sprung and pivoted on an axis pin. When it reaches the upper surface of the breech casing it is depressed against its spring and remains there for the rest of the backward action.

II: Forward Action

1. Assume the gun to be cocked and a fully tensioned magazine containing ammunition to be in the magazine catches.

Sear Depression

2. When the trigger is pressed the sear leaves the bent, and the compressed return springs drive forward the piston rod and breech block. Rod and block move forward together for a small distance as they gain speed.

Action of the Feed Piece

3. When free of the upper surface of the breech casing, the feed piece has its leading edge forced upwards by its own spring and plunger.

Cartridge Guides

4. The feed-piece leading edge engages behind the base of the next round in the cartridge guide lips, pushing it out of the lips and then forward.

Bullet Guide

5. Integral with the magazine base is a bullet guide. The bullet nose is guided by this into the chamber. Correct feeding is made certain by designing so that the upper surface of the round comes against the upper surface of the chamber before the cartridge leaves the cartridge lips.

Engagement of Extractor Claw on Cartridge Rim

6. The chamber now decides the direction of the round and the base of the cartridge is forced down the rim engaging behind the extractor claw. This

claw is sprung, principally to prevent fracture on recoil and ejection.

Cartridge-Rim Stop

7. The cartridge rim top and bottom now strike the cartridge rim stop on the end of the barrel arresting the forward motion of the breech block. Note that the piston can still move forward and the breech is not yet locked.

Firing Pin Spring: Safety Device

8. Think of a passenger standing up in a tube train that suddenly brakes. The train stops, and he shoots on. This is what would happen to an unsprung firing pin. The breech block suddenly stops on closing, and the pin would shoot forward and fire the round in the breech before the block were locked. Result, explosion into gunner's face. Hence the firing pin spring.

Locking of the Breech

9. When the breech block is arrested, the forward inclined edge of the rear projection of the piston acting on the lower rear inclined edge of the breech block forces the breech block upward. This causes the land on its top edge at the rear to engage in the recess in the upper surface of the breech casing. This might be described as a safety device although it is an obvious necessity.

Safety Distance

10. The piston rod now moves forward a further $\frac{3}{10}$ in. before the firing pin is struck, making

sure the breech is locked. (This safety device applies more in the backward action.)

Firing Pin

11. Before the piston rod is arrested in its forward movement by the shoulders stopping against the two transverse stops in the breech casing, the front face of the front projection compresses the firing pin spring and forces the firing pin through the firing pin hole. The pin then strikes the cartridge cap.

Magazine

12. Directly the round is taken from the cartridge guide lips of the magazine, the magazine driving spring exerts pressure on the round. This drives all the rounds round a further space and the next round presents itself in the cartridge guide lips for feed.

Remember: Safety Devices

- 13.—(i) Locking to prevent blow-back.
(ii) Firing pin spring.
(iii) Safety space after locking and before cap is struck— $\frac{3}{10}$ th of an inch.
(iv) Safety space before unlocking to dissipate pressure.
(v) Gas escape hole.

And don't forget that the safety catch *only* works when the gun is cocked.

PART VI

VICKERS GAS-OPERATED GUN: MAGAZINES

I: Description

1. There are two kinds of magazines ('drums' or 'pans' in the vernacular); the No. 1 Mark I, 60 round (practice) magazine and the No. 2 Mark I, 100 round (operational) magazine. The former is used largely for range work, and has small differences that can easily be seen when it is met. The latter has many refinements and is far easier to fill despite its greater capacity.

The No. 2 Mark I, 100 round (operational) magazine

2. There are four parts:—

- (i) Magazine body,
- (ii) Top plate (with main spring),
- (iii) Follower (or dummy round),
- (iv) Loading lever (carrying handle combined).

The Magazine Body

3. The magazine body is a shallow cylindrical CONTAINER open at the top. Constructed of a light steel alloy, it has a top edge that is flanged.

At front and rear CATCH PLATES are riveted and spot-welded. The catch plates engage in the magazine catches on the body of the gun.

A SLOT resembling a round in shape is cut in the base of the body directly opposite to the feed-way in the gun body.

Part of the slot length, from the outer edge towards the centre, is bounded by CARTRIDGE GUIDE LIPS. These are designed to retain a round in a convenient position for removal by the feed piece.

The LEFT LIP is movable, pivoting on a bolt which is spot-welded to the bottom plate. The lip is secured to the bolt by a washer and split-pinned nut.

The MOVABLE LIP is retained by a flat steel spring catch riveted at one end to the band or rim of the magazine.

4. Beneath the bottom plate, at the front of the ammunition slot, a grooved projection called the BULLET GUIDE deflects the nose of the bullet downwards as it is pushed forward.

Fitted centrally inside the magazine body is the CENTRE POST, which is riveted to the bottom plate.

Concentric around the centre post, and secured to a flange on it, is a CYLINDER against which the nose of the rounds butt.

Surrounding the cylinder a wire forms the guide for the bullets separating the layers of rounds. Note that there are 35 rounds in one layer or circumference of the magazine. The BULLET GUIDE WIRE is secured at the base to a bracket riveted to the bottom plate, and at the top by engagement in a slot in the top edge of the cylinder.

The centre post is drilled at the top to accommodate the TOP PLATE RETAINER, and grooved for the SECURING PLATE of the loading lever.

A SPRING is riveted to the bottom plate, near the inner end of the slot. Thus the following round is held while the round in the lips is being fed.

A GALLERY is formed inside the magazine body band by the cartridge head guide ring, which supports the cartridge bases.

This spiral path is terminated at the base by a CARTRIDGE LEAD which deflects the rounds into the slot; and at the top end by a FOLLOWER STOP.

The Top Plate

5. The TOP PLATE is a steel plate, having 35 SEPARATORS arranged radially and riveted to its lower face. A shallow recess in the middle of the top plate forms a HOUSING for the main spring.

A HOLLOW CENTRE PIECE fits over the centre post, to form a bearing for the top plate when the magazine is assembled.

The top plate is secured to the magazine body by the securing plate of the loading lever, which engages the groove; and the top plate retainer, which engages the holes in the centre post.

TWO STUDS are provided on the top plate for engagement with the special ammunition filling machine now in service (usually called the 'Hopper').

6. The MAIN SPRING is of clock pattern. The inner end is anchored to a HUB having flats to engage with corresponding flats on THE BUSH OF THE LOADING LEVER.

The housing for the spring is closed by the top plate cover, which is provided with an inspection window. Through this window, which has a cover pivoted about the centre post, the main spring's state of tension can be examined. A fully loaded, fully tensioned magazine should have no coils visible through the window.

The Follower

7. The follower is shaped like a complete round of ammunition, except that a tail is riveted near the base. The duty of the follower is to support the last round in the cartridge guide lips. The follower's tail prevents it being fed out of the magazine.

The Loading Lever

8. The loading lever is a flat steel bar notched to accommodate a tensioning handle which gives greater 'purchase' when applying or releasing tension on the main spring.

At the centre of the lever is a HOLLOW BUSH which fits over the hollow centre post.

This bush has FLATS CORRESPONDING TO THOSE INSIDE THE HUB of the main spring in the top plate.

Near one end of the lever is pivoted a securing plate which swings into the groove in the centre

post and on the same pivot the top plate retainer pivots.

The top plate retainer is nothing more than a split pin, provided with a thumb piece for ease of manipulation, hinged on the loading lever to be inserted in the centre post thereby retaining tension in the main spring.

A leather handle is riveted to the lever for carrying the magazine and placing it on and removing it from the gun.

II: Action

Loading and Tension

1. Wherever possible, the gunner should always load his own magazines. Assuming no mainspring tension, the movable lip is pushed over its spring catch into position.

The magazine is now placed on a tensioning device. A tensioning handle is engaged in the loading lever, and with the top plate retainer disengaged the loading lever is turned through a minimum of five complete turns. As soon after this as the loading lever is fore and aft, the top plate retainer must be fully engaged in the holes in the centre post; then the tensioning handle can be disengaged from the loading lever.

(Fuller and more detailed instructions for loading are given in Part VII.)

Action

2. The fully loaded and tensioned magazine is placed on a cocked gun set to fire. The tension of the main spring is being maintained as follows:—

(i) The top-plate retainer holds the loading lever to the static magazine centre post.

(ii) On the loading lever is the hollow bush whose flats engage the female flats of the hub, so that the inner end of the spring is anchored.

The outer end of the spring is attempting to drive the rotating top plate round in a clockwise direction, but is prevented from doing so by the round in the cartridge guide lips which cannot be moved by rotating movement.

3. The trigger is depressed and the forward action takes place. Driven by the compressed

return springs, the feed piece engages behind the base of the first round in the cartridge guide lips and pushes it forward out of the magazine.

Now the top plate is free to turn $1/35$ th of a revolution under the influence of tensioned main spring. All the rounds move round one in their respective spacers, gradually descending the spiral paths of bullet and cartridge base guides. If the cycle of operations be repeated, each round in turn is fed to the cartridge retaining spring whilst the preceding round is ready for removal by the feed piece; thence down the cartridge lead to take its place in the now empty cartridge lips. The follower performs this duty for the last round.

III: Care of the Magazine

1. Never accept a 'suspect' or dented magazine.

2. Fill and tension your own magazine for safety.

3. Fill by hand if possible. The mechanical hopper cannot think.

4. Make 'Bottoms up' your motto when laying magazines on any surface before stowing on racks or pegs.

5. Polish the inside of the cartridge guide lips periodically if you want a fast gun.

6. Always tension and untension on the device provided.

7. See that handles are fore and aft and that leather straps are supple and not perished.

8. Always inspect for position of first round (right back in lips) and for tension before take off.

9. Treat a magazine as you would a ten-guinea watch. Don't drop it bang it about or leave it anywhere where it can collect dirt grit and bits of grass. This applies now, in the classroom, at the cleaning bench, on the range. For what you do with (or without) conscious thought now, you will do by habit later on. Imagine the feelings of an air gunner who is just going to shoot down a Messerschmidt on his tail and then finds his gun has jammed because he dropped the magazine and dented it. Put yourself mentally in the place of this air gunner whenever you handle a magazine.

PART VII

VICKERS G.O. GUN: LOADING AND UNLOADING

Magazines and Gun

Magazines: General

1. Except in emergency, magazine loading and removing magazine tension must not be attempted without the proper tensioning device and handle. Otherwise badly gashed hands are likely.

There are two types of magazine to consider:—

No. 1, Mk. I or practice magazine. 60 rounds. Fixed cartridge guide lips.

No. 2, Mk. I or operational magazine. 100 rounds. One fixed and one movable cartridge guide lip.

60-round magazine: loading

2. Insert a round into lips and press into magazine.

Rotate top plate of magazine with fingers of left hand until the round is clear of lips and next space is visible.

Repeat loading in this manner till magazine is full.

Make sure no space is missed—otherwise stoppages will result. As a good check on loading, arrange rounds in batches of 60.

Replace movable lip and engage properly by the spring catch.

60-round magazine: to tension main spring

3. Place magazine on tensioning plate and bring hooked end of loading lever over the rear catch place.

Engage winding handle with loading lever of magazine.

Steady magazine, rotate winding handle $3\frac{1}{2}$ turns anti-clockwise, engage retainer and remove winding handle.

60-round magazine: removing tension

4. Place magazine on tensioning plate and engage winding handle with loading lever of magazine.

Take weight of the spring and disengage retainer.

Ease back winding handle until tension is removed. If magazine is not to be unloaded, replace retainer.

60-round magazine: unloading

5. Remove tension from main spring.

Remove top plate and take out the bullet support and platform.

Invert magazine; rounds will fall out.

Assemble magazine and replace retaining pin.

100-round magazine: loading

6. Ensure there is no tension on main spring; disengage retainer.

Ensure that securing plate of loading lever is properly engaged in the groove in centre post.

Ensure that follower is visible through lips and that hooked end of loading lever coincides approximately with front catch plate.

Invert magazine and place on loading post.

Release movable lip.

Hold magazine with left hand and take ammunition in right hand.

Insert round in the lips and press it into the magazine.

Rotate top plate of magazine with fingers of the left hand until round is clear of lips and the next space is visible.

Repeat until magazine is full.

Ensure that no space is missed, or stoppages will result. As a check on loading it is a good plan to have ammunition arranged in batches of 100 rounds.

Replace movable lip and ensure it is properly engaged by spring catch.

100-round magazine: to tension main spring

7. Place magazine on tensioning plate and bring the hooked end of loading lever over rear catch plate.

Engage winding handle with loading lever of magazine.

Steady magazine; rotate winding handle anti-clockwise until maximum tension has been applied; engage the retainer in first slot below position of maximum tension. Take care that the retainer is not forced into engagement if it coincides with a slot at maximum tension. Remove winding handle.

100-round magazine: removing tension

8. Place magazine on tensioning plate and engage winding handle with the loading lever of the magazine.

Take weight of the spring and disengage retainer.

Ease back winding handle until tension is removed; if magazine is not to be unloaded, replace the retainer.

100-round magazine: unloading

9. Remove tension from main spring.

Release movable lip.

Rotate top plate; rounds will fall out.

The importance of swift magazine changing

10. Rapid and accurate magazine changing is a most important part of the air gunner's art. Cold,

wearing thick gloves, strapped in and yet bumped and tossed about, and being fired at by enemy machine guns—these are extreme conditions under which he may have to engage the enemy. An enemy aircraft is closing to attack, and just when it is nearing decisive range, the magazine on the gun is found to be empty—perhaps after previous bursts of fire. At this point there are only two alternatives—to shoot down or be shot down. The air gunner who can continue to watch the enemy and in two rapid passes rip off the empty magazine and snap on a loaded magazine wins. The man who has to fumble, let go of the gun, grope for a fresh magazine, and take his eyes off the enemy, loses.

Therefore, *practice, practice and practice* until your magazine drill becomes a quick-change act worth boasting about. Skill in magazine changing acquired in lecture rooms and on ranges may save a British aircraft and crew and rob the enemy of a similar valuable fighting weapon and team.

Gun Loading

II. (i) *Gun angle*: Always keep it pointed at the target.

Movement: Must be smooth and decisive. Use the left hand only for the single Vickers G.O. Gun.

Speed: Must be acquired after the perfection of slow motion practice.

(ii) Cock the gun smartly with the left hand. Do not lean away from the gun; use the biceps and keep head and body still.

(iii) Return cocking lever to forward end of slide.

(iv) Seize magazine holding strap; turn clockwise 10° and remove from stowage.

(v) Ease the cartridge guide lips down the chamfer in the feedway, until the two rear lugs engage in the rear magazine catch. This will also locate the front magazine catch.

(vi) Transfer hand smartly from leather handle, striking magazine immediately with clenched fist into front catch (on the ground listen and feel, in the air feel for it to engage).

(vii) At first, test by pulling on leather strap. Later abandon testing; it is a waste of vital time.

The gun is now ready to fire.

Unloading Gun

12. (i) Strike rear magazine catch with the heel of the hand. Snatch rear end of the strap with fingers of the same hand, giving the rear end of magazine a sharp upward jerk. This will bring magazine away from the gun in minimum time.

(ii) If the breech block is in forward position, cock gun and fire at target.

(iii) If the breech block is in rearward position, press trigger, cock again, press trigger.

(iv) Always keep gun pointed at target. Gun is now unloaded.

PART VIII

VICKERS G.O. GUN: STOPPAGES AND TOOLS

Stoppages: Cause and cure

1. An operational Vickers G.O. gun has a stated life of 10,000 rounds. Yet in training units there are guns which have fired 40,000 rounds on the ranges without the amenities of slipstream air cooling. These guns are still in constant use, a tribute to their simple and hard-wearing mechanism.

2. Stoppages are caused chiefly by:—

(i) Dirt and carbon in an otherwise serviceable gun. This should never occur, yet it does.

(ii) Incorrectly assembled gun parts. One might conceivably leave out the breech block or ejector when assembling the gun; but a protruding extractor spring or return spring guide malalignment are the usual troubles. Method in assembling should obviate these causes.

(iii) Fracture of gun components. Can be almost entirely eliminated by changing each part as its 'life' expires.

(iv) Faulty ammunition. Rarely occurs.

(v) Bent or dirty magazines. Caused by dropping on concrete, muddy grass, etc.; the remedy is entirely in the gunner's hands.

Immediate Action: technical definition

3. The immediate application of a *probable* remedy for a stoppage, based on the position of the piston and condition of the gun. *It must not be considered complete* until the gun is again functioning satisfactorily. The immediate action table is set out to give a clear indication of the nature and cause of each stoppage and the probable remedies.

Immediate Action: Air Gunner's definition

4. A drill carried out swiftly and automatically, without ceasing to regard the target through the sight, to

(i) clear a minor stoppage,

(ii) diagnose a breakage or major stoppage.

If his automatic drill does not render the gun fit to fire again, immediate action has ended. He

must now carry out a more detailed diagnosis based on his knowledge of gun construction and action.

Nos. 1, 2 and 3 Stoppages

5. The variety of stoppages possible is frightening at first sight. But split under three headings and learned steadily stage by stage they can soon be mastered.

First learn them by looking at the cocking handle; later by feel only. 'Ace' air gunners know stoppages by the sound they make (on the ground) and the feel of the cocking handle when applying the immediate action.

So that Sound, Touch, and Sight, with knowledge learnt by lecture and experience, enable the gunner swiftly to diagnose and remedy temporary stoppages of the gun.

Cocking Handle Tensions

6. *No. 1 Stoppage.* Tension felt immediately.

No. 2 Stoppage. No tension felt at beginning of drawing back the cocking handle, but it is felt soon afterwards.

No. 3 Stoppage. No tension felt till cocking handle has been drawn almost fully back.

Cocking Handle Positions

7. *No. 1 or 1st Position.* Rear end of piston below the rear magazine catch lever, cocking handle fully forward.

No. 2 or 2nd Position. Rear end of piston to the rear of the rear magazine catch lever; cocking handle to the front of the rear magazine catch lever.

No. 3 or 3rd Position. Rear end of piston not visible; cocking handle below or to the rear of the rear magazine catch lever.

The feel of these positions can be learnt by placing a wooden distance piece between the front face of the breech block and the cartridge rim stop and pulling the cocking handle back until tension is taken on the return springs.

Learning Stoppages: Mnemonic Method

8. Gunners first usually learn stoppages by remembering the following:—

Freddie	Fêtes	Elsie	'Cos	She	Expects	Enjoyment
F	F	E	C	S	E	E
Feed	Firing	Exit (deflection)	Cross Feed.	Separated Case	Extraction	Ejection
No. 1		No. 2			No. 3	

Not all stoppages are covered, but it helps considerably with a clean gun.

Learning Stoppages: Family Tree Method

9. I have a stoppage. *I keep my eyes glued to the sight and the gun pointing at the enemy; then grasp the cocking handle. By easing back I find I have a:—*

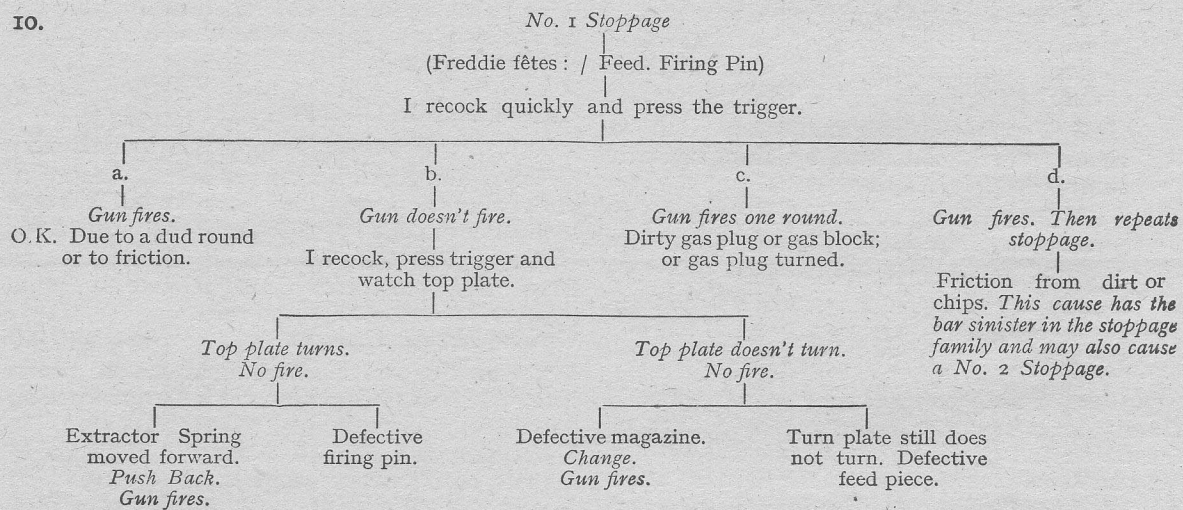
No. 1 Stoppage

No. 2 Stoppage

No. 3 Stoppage

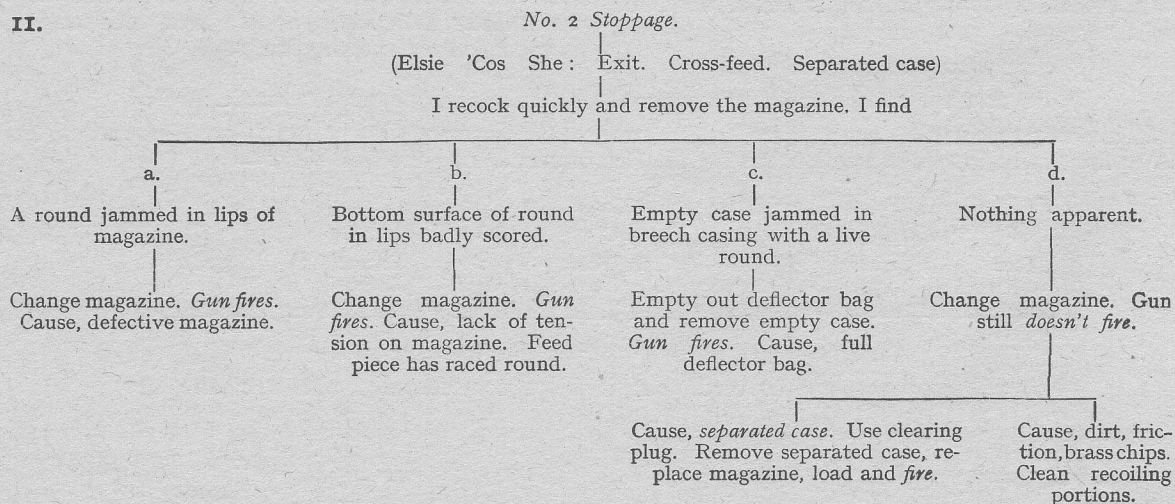
Treatment of the No. 1 Stoppage

10.



Treatment of the No. 2 Stoppage

11.



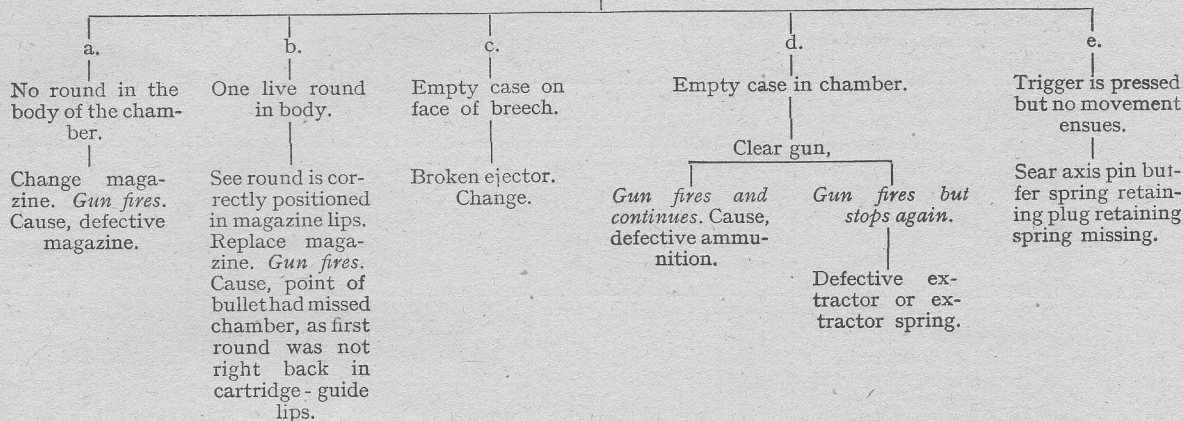
Treatment of the No. 3 Stoppage

12.

No. 3 Stoppage.

(Expects Enjoyment: Extractor, Ejector.)

I recock quickly and remove the magazine. I find

**Stoppages and Common Sense**

13. From the Stoppage Family Tree it is seen:—

(i) *No. 1 Stoppage.* Cock and carry on. No fire, recock and watch magazine top plate.(ii) *No. 2 Stoppage.* Cock. Remove magazine and be suspicious of a separated case or a full deflector bag. Examine round in the magazine cartridge guide lips.(iii) *No. 3 Stoppage.* Cock. Remove magazine and open deflector to make diagnosis.

Remember dirt, burrs, and brass chips can cause any stoppage. Fractured return springs sometimes (though very rarely) jam on the return spring guide and thereby jam the gun.

Test springs at every cleaning operation and exchange when scheduled life is reached, even though springs pass the test imposed.

Immediate-action table

<i>Position of Rear end of piston</i>	<i>Immediate action</i>	<i>Result</i>	<i>Cause</i>	<i>Remedy</i>
First	Cock the gun. Fire and watch the top plate of the magazine.	(1) Gun Fires.	(1) Miss fire due to defective ammunition.	Nil.
		(2) Gun fires but repeats stoppage.	(2) No feed due to :— (i) Sluggish magazine. (ii) Incomplete backward movement due to (a) Friction, dirt or chips. (b) Fouling in the gas block or gas plug port. (Note. (ii) (a) May also give a stoppage in the second position).	(2) (i) Change magazine. Continue firing. (ii) (a) Cock the gun sharply and fire. If stoppage is repeated, remove magazine clear gun, wipe away any brass chips which are visible and oil the piston rod through the feedway in the body. Replace magazine and continue firing. (b) Correct maintenance of gun.
		(3) Top plate rotates but gun does not fire.	(3) Defective firing pin.	(3) Remove magazine. Clear gun. Change breech block. Replace magazine and continue firing.
		(4) Top plate does not rotate and gun does not fire.	(4) No feed due to :— (i) Empty magazine. (ii) Defective or dirty magazine.	(4) (i) Change magazine. (ii) Change magazine. Correct maintenance of magazine.
		(5) Stoppage repeated after changing magazine in (4).	(5) Defective feed piece or feed-piece spring.	(5) Remove magazine. Change breech block. Replace magazine and continue firing.

ARMAMENT

STUDENTS' NOTES

<i>Position of Rear end of piston</i>	<i>Immediate action</i>	<i>Result</i>	<i>Cause</i>	<i>Remedy</i>
Second	Cock the gun. Remove the magazine. A. If a round is jammed in the lips change the magazine and continue firing.	Gun fires.	Defective magazines.	Correct maintenance of magazine.
	B. If a round is correct in the lips. Clear the gun. Empty deflector bag. Replace magazine and continue firing.	(1) Gun fires. (2) Gun repeats stoppage	(1) Full deflector bag. (2) Separated case.	— (2) Remove magazine. Clear gun, using clearing plug to remove separated case from the chamber. Replace magazine and continue firing.
Third	Cock the gun. Remove the magazine. A. If there is no round in the body of the chamber, change the magazine and continue firing.	Gun fires.	Defective magazine.	Correct maintenance of magazine.
	B. If live round only is in body, clear gun. See that round is correctly positioned in magazine lips. Replace magazine and continue firing.	Gun fires.	Point of bullet misses chamber, usually because the first round was out of place in the lips before the magazine was put on the gun.	Care in stowage during transport and in fitting to stowage pegs in aeroplane.
	C. If empty case is on face of breech block. clear gun. Change ejector. Replace magazine and continue firing.	Gun fires.	Defective ejector.	—
	D. If empty case is in chamber, clear gun. Replace magazine and continue firing.	(1) Gun fires. (2) Gun fires but repeats stoppage.	(1) Defective ammunition. (2) Defective extractor or extractor spring.	(1) Nil. (2) Remove magazine. Clear gun. Change breech block. Replace magazine and continue firing.

PART IX

VICKERS G.O. GUN: CARE AND MAINTENANCE

I: General Notes

1. Think constantly of the gun in relation to its operational importance and value. In squadrons the care and maintenance of guns is the responsibility of the crew, and they can and should look to the armament specialists for advice and assistance only. The man who takes a pride in keeping his own gun tuned up to concert pitch will achieve the most successful results in air firing. The operational aspect of gun care and maintenance has, therefore, been stressed in these notes, but the processes apply equally well when the gun is used for range firing.

2. In the traditions of British engineering, the Vickers G.O. gun is an excellent piece of mechanism when new; but just as a motor-car or motor-cycle engine must be periodically inspected, oiled, and 'decoked', the gun also must receive periodical attention if it is to continue to give satisfactory service. Inspection and cleaning can be divided into three groups:—

- (a) PREPARATION of the gun before firing.
- (b) INSPECTION between sorties on which the gun is fired. This inspection is naturally most often met in fighter squadrons when aircraft land to refuel and rearm.
- (c) INSPECTION AND CLEANING after sorties, preparing the gun for the next day.

Inspection and cleaning in all three groups include magazines, which are just as important as the gun itself.

II: Preparation of Gun for Sortie

1. Inspect the split pins in the following:—

- (i) Flash Eliminator,
- (ii) Gas Plug,
- (iii) Front Magazine Catch,
- (iv) Cocking Handle,
- (v) Yoke,
- (vi) Body Extension, two split pins,
- (vii) Deflector Hinge Pin,
- (viii) Sights, two split pins.

It is hard to visualize from the printed word where these split pins are, but when looking at the gun it is easy to trace them in logical order.

2. (This inspection is most important.) Open the deflector casing and see that the extractor spring is in the fully-back position in the breech block. If not, push it back with a screwdriver. If this has to be done in flight, it can be done by cocking the gun, inserting the nose of a round in the front end of the deflection opening, and then pressing the trigger.

3. Dry out the barrel with a piece of 'four by two' and a cleaning rod.

4. Wipe all excess oil off the recoiling portions, so that on passing the finger over them only the faintest suggestion of oil is felt. This also is most

important. Even 'anti-freezing oil' becomes thick and can actually freeze at the extremely low temperatures of high altitudes. In the early days of the war, when the Royal Air Force first started high altitude flying on a large scale, there were several instances of guns refusing to fire at critical moments because the moving parts were clogged with an excess of congealed 'anti-freezing' oil.

5. Clean the outside of the gun with a dry rag;

6. Make sure that the gas cylinder will spin freely. If it does not, somebody has blundered when assembling the gun.

7. Inspect magazines for:—

- (a) Cleanliness;
- (b) Tension: Done by looking through the inspection hole;
- (c) Freedom from obvious distortion and dents;
- (d) Fore and aft alignment of the handles;
- (e) Correct positioning of the first round.

8. Fit on the gun a magazine charged with dummy rounds. Cock and press the trigger three times, observing if feed, extraction, ejection and deflection are carried out smoothly.

9. If a reflector sight is fitted, switch on and see that the dimmer works correctly. Inspect the sight bracket for rigidity, and wipe the screen clear with a silk handkerchief.

10. If the gun has been previously subjected to the heavy vibration of firing, and time will permit, check the harmonization of the sights on the reduced range harmonization board.

11. Place a rubber sheath over the muzzle end of the barrel. This is done to prevent condensation in the barrel, the rubber sheath being fired through in air action.

12. Check over the contents of the satchel for tools and spares to be taken into the air. It should contain the following:—

- Lanyard to pull back the cocking handle,
- Clearing plugs to deal with a separated case,
- Dummy extractor to remove cases from chamber,
- Wire loop to lift empty cases off the piston rod,
- Screwdriver,
- Hide-faced hammer,
- Complete breech block,
- Ejector and ejector spring cover,
- Piston rod,
- Feed-piece extractor,
- Firing pin and springs.

Make sure that the body extension securing pins are nice sliding fits. This will make all the difference should a breech block have to be changed in emergency.

III : Inspection between Sorties

1. Replenish the stock of loaded magazines; if any fresh magazines are introduced into the aircraft inspect them in the manner described in Part II, para. 7.

2. (i) Clean out the barrel with a piece of 'four by two' and a cleaning rod.

(ii) Inspect extractor spring for forward movement.

(iii) Remove recoiling portions and wipe with a clean rag. Look for chips of brass, cartridge caps or carbon in the body way, wipe the cartridge rim stop, and replace recoiling portions.

(iv) Renew rubber muzzle sheath.

(v) Test sight bracket for rigidity.

*IV : Inspection after Sorties***General**

1. Properly speaking, inspection after sorties is a combination of the following:—

(i) Preparation;

(ii) Stripping and cleaning;

(iii) An interval in which hands are cleaned and the gun history sheet is checked;

(iv) Inspecting and testing;

(v) Re-assembling and reporting.

Preparation

2. After landing remove the sights and stow them away. Pull through the barrel as soon as possible and generously oil all the gun except the body extension. The sooner the rest of the preparation is carried out after landing the easier it will be.

Obtain in the armoury workshop the following:—

(i) A clean zinc covered bench with vice fitted;

(ii) Vice clamps;

(iii) A roll of 'four by two';

(iv) A couple of sheets of 00 emery paper;

(v) Two $\frac{3}{8}$ " B.S.F. spanners, hide faced hammer, punches, wire brushes, pliers, and split pins;

(vi) Cleaning rod, steel rod, and flannel mops;

(vii) Flash-eliminator gas block.

Stripping and Cleaning

3. There are three phases in the cleaning of a gun:—

(i) *Primary*. Carried out after landing. Already described.

(ii) *Main*. About to be explained.

(iii) *Subsequent*. Carried out seven days after the main cleaning if no firing has taken place during the interval.

4. Strip the gun and deal first of all with the barrel in case nickel fouling has occurred. Wear of the gun barrel may be caused by three types of fouling:—

(i) *Powder Fouling*. This is removed when the gun is pulled through directly after landing. The fouling is easily disposed of if dealt with promptly. Indeed, some of the air gunners operating in Blenheims over Dunkirk used to carry out the primary cleaning of the gun while they were still airborne.

(ii) *Chemical Fouling*. This occurs if powder fouling is left in the barrel; it results in pitting of the metal and shortens the working life of the gun parts.

(iii) *Nickel Fouling*. Caused by nickel tearing off the bullet envelope and sticking in the barrel grooves. Armour piercing bullets in particular cause this type of fouling.

To diagnose nickel fouling, vigorously pull through the barrel with a steel rod and 'four by two', renewing the material until it emerges clean. Then hold the barrel up to the light and twist it slowly so that each groove may be inspected. The grooves should be clean, clear cut, and shining. If white streaks can be seen in them, nickel fouling has commenced.

In advanced cases the chips of nickel stand out of the muzzle end like hairs on a gooseberry. If mixed with oil and dust they can obstruct a bullet to such an extent that the barrel bulges or even fractures.

Removing Nickel Fouling, & Oil Cleaning

5. Take two tablets of King's Norton Nickel Solvent (which look rather like aspirin tablets). Grind them into a fine powder and mix with 40 c.c.s. of .880 ammonia (roughly half a N.A.A.F.I. cupful). (Don't memorize.)

Block the breech end of the barrel and the gas plug, pour in the denickling mixture and leave for at least 20 minutes.

6. Immerse the moving portions in a bath of cleaning oil. Different units use different oils. Type A, Special; Armesan, Special; varying mixtures of paraffin and mineral oil; and in some cases petrol only, which must only be used in the open air.

7. Chip the carbon out of the gas plug with a special punch provided.

Scrape the front end of the gas cylinder with an old penknife to remove the carbon. Then hold the cylinder firmly but gently between the vice clamps and push the cleaning rod and wire brush vigorously backwards and forwards. Repeat with flannel mops until the inside surface has a mirror polish.

8. Clean the body of the gun with an old mop covered with 'four by two' and finish off with a clean mop.

9. If the carbon on the piston rod and piston head is firmly caked on, tap gently and carefully with an 8 oz. hammer to loosen it. Polish with 00 emery paper or a scratch card, paying particular attention to the piston rings.

10. Strip the breech block of its components and clean with 00 emery paper where necessary.

11. Clean the return springs and guide with cleaning oil and a clean rag.

12. Take a rag dipped in fresh cleaning oil and wipe over the body extension ejector, spring cover, and deflector.

13. By now 20 minutes or so will have elapsed. Now take the barrel to the nearest drain, and holding the barrel nose with the thumb and forefinger of the left hand tip out the contents of the barrel with the right hand. It will be noticed that the liquid has taken on a bluish tinge. This denickeling process must be repeated until the liquid is as colourless when it comes out as it was when put in.

14. Next soak the barrel in gun-cleaning oil, Type A, for ten minutes; dry and clean with flannelette and cleaning rod. Soak the gas cylinder and piston rod for the same time in the same type of oil, and then remove all traces of oil with a clean, dry rag.

15. Lay all parts on the clean bench ready for inspection. Be careful not to mix them up with parts from other guns.

16. Here pause to wash and dry the hands and get the gun history sheet. Most gun-cleaning rooms have a wall chart showing the 'life' of every gun component expressed in 'number of rounds fired.' Work out the total number of rounds fired since the different gun parts were new and exchange any part which has reached or passed its scheduled 'life.' Don't forget to grease and label the parts that are to be exchanged; this will prevent them getting mixed up with other spares and being reassembled into another gun.

Inspecting and Testing

17. Inspect the return springs for obvious flaws. Roll them on a flat surface and scrap them if they are bowed. Test for the length.

The inner spring should be not less than 19 in. long.

The outer spring should be not less than 13 in. long. (Don't memorize.)

If either of these springs fails the test, exchange it.

18. Inspect the return spring guide for chips and burrs and test for bow by rolling on a flat surface.

19. Taking the breech block components in turn, measure the firing pin for correct length, check the extractor spring for tightness in its position, and the feed piece for freedom of return after it has been pressed forward. Inspect the breech block generally for cracks and burrs.

20. Examine the piston for cracks, especially on the front projection. Remove any burrs with an oilstone.

21. Gently stone off any burrs on the body of the gun. Inspect the cocking piece for fractures. See that the ejector spring cover fits securely and that the ejector has no cracks or burrs. Test the magazine catches for quick spring return and renew any sluggish springs.

22. Dry and then lightly smear with anti-freezing oil the axis pins in the body extension. *Never strip and never immerse them in dirty oil or paraffin.*

23. If the gun has been slowing up, suspect the main buffer. It should not spin, and pressing the main buffer against the edge of a bench should not compress it when the weight of a normal man is pushed against the body extension.

24. See that the sear is not burred or cracked, and that the 'fire' and 'safe' lever is free in its action.

Report any body-extension faults to the officer or N.C.O. in charge of the Gunnery Section.

25. There are five gauges for barrel testing. They should all be used on the following occasions:—

(i) On first taking over a gun.

(ii) At definite intervals in the life of the gun. Say after every 4,000 rounds fired.

(iii) After a sortie on which a large number of rounds have been fired in a short time.

26. The gauges are as follows (don't memorize):—

(i) *The 0.303 inch gauge.* It is mounted on a rod and should pass down the whole length of the barrel. Failure to do so usually means that nickel fouling is present. In rare cases it may mean that the barrel is distorted.

(ii) *The 0.307 inch gauge.* This is called a 'reject gauge' because the barrel is rejected and a fresh one procured if the gauge passes right down the bore. In such a case the bore would obviously be oversize.

(iii) *The plug lead gauge No. 2.* This is used to indicate wear at the breech end.

(iv) *The 0.308 inch gauge.* If this enters the muzzle end past the engraved mark the barrel must be exchanged. Such exchanges

were not uncommon when cord pull-throughs were used and cord wear took place at the muzzle end. To-day such wear is rarely met.

Reassembling

27. Assemble the gun, putting a bare 'sensation' of oil on the piston rod projections, the stern end and the body-way. Leave the gas cylinder gas block and the front end of the piston perfectly dry. Make sure that the gas cylinder turns freely on the gas block boss at the front

end and in the gun body at the rear end. Insert and turn over all split pins. Lightly oil the outside of the gun.

Records

28. Check that all rejected parts have been greased and labelled. Enter up the gun history sheet.

It's a good plan too to keep a chart as shown below. It will be found of use both to you and to inspecting specialists.

COMPONENT	GUN NUMBER	THOUSANDS OF ROUNDS FIRED								
		1	2	3	4	5	6	7	8	9
FEED PIECES	1									
	2									
	3									
FIRING PINS	1									
	2									
	3									

FIG. 10. ACTUAL LIFE OF GUN COMPONENTS IN ROUNDS FIRED.



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